Southeast Zone Interagency National Fire Danger Operating Plan

2012

Coronado National Forest

Arizona BLM Gila District

U.S. Fish and Wildlife Service

National Park Service - Southern Arizona Group

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Signature Page

Forest Fire Staff Officer - Coronado National Forest	Date
Fire Management Officer - AZ BLM Gila District	Date
Fire Management Officer - Buenos Aires National Wildlife Refuge	Date
Fire Management Officer - Saguaro National Monument,	Date
Fire Management Officer - Chiricahua National Monument	Date
Fire Management Officer – Tohono O'odham Nation	Date

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Introduction

The National Fire Danger Rating System (NFDRS) is being used to support the fire management decision making process within the Southeast Arizona Zone - SEZ (USFS Coronado National Forest [CNF], Bureau of Land Management [BLM], National Park Service [NPS], Tohono O'odham Nation [TON]). Fire-danger ratings are guides for initiating preparedness activities and selecting the appropriate level of initial response to a reported fire. The purpose of this Interagency Fire Danger Operating Plan is to analyze and develop danger rating areas to manage the NFDRS for all participating agencies. Just as agency administrative boundaries are not delineated on the basis of climate, fuels, or topography, neither is fire occurrence and fire danger. A combined NFDRS operating plan will maximize the efficiency and effectiveness of the agencies respective fire management organizations. The plan was developed to assist with planning and operational decisions relative to fire danger, preparedness, resource needs, personnel briefing, situational awareness, and implementing fire restrictions.

This operating plan is a tool that will assist fire managers in understanding and utilizing fire-danger information in the day-to-day management decisions and in long term fire preparedness planning. It is a framework for a consistent thought process to apply fire-danger rating within the jurisdictions of the Southeast Zone

This plan was developed through analysis of fuels, weather, and topography. A matrix (Table 1, Fire Danger Technical Group) was developed to analyze the problems that exist, the target groups that will be impacted, and the fire-danger rating component or index that could be used to assist in making decisions to reduce the problems. The analysis does not take into account other factors such as resource drawdown, training levels, political factors, overriding budget constraints and other external factors.

The role of the fire danger rating operating plan is to guide the application of the NFDRS at the unit level. It:

- Identifies the fire problems within the Southeast Zone.
- Defines which NFDRS indices and components best fit the fire management decision needs among the agencies.
- Defines fire-danger rating areas to which NFDRS outputs apply.
- Defines which NFDRS fuel model, slope class, and climate class that represent each fire-danger rating area.
- Designs a fire weather station network to collect the meteorological data necessary to support fire-danger rating and fire management decisions.
- Relates fire-danger and fire business to determine staffing levels, preparedness levels, preplanned dispatch levels, and fire prevention activities within the planning area.

In order to use this plan effectively, fire managers must understand the four basic principles of the NFDRS:

1. The system only relates to the potential of an initiating fire that spreads without spotting through continuous ground fuels.
2. The system only addresses those aspects of fire control strategy affected by fire occurrence and fire behavior. The system is based on the concept of containment, not extinguishments. This allows limiting the scope of the rating to the behavior potential of the head fire.
3. The ratings are relative not absolute.
4. Fire-danger is rated on a worst case basis. This important principle must be understood to properly interpret fire-danger rating.

NFDRS is not intended to predict how every fire will behave but to provide for short range planning. This system will determine the average worst case burning conditions across the landscape understanding that some risk is involved because the agencies cannot afford to staff for the absolute worst case conditions. The NFDRS outputs are relative values (indices) of fire spread (spread component), flame length (burning index), and available fuel energy (energy release component) are a few that are commonly used.

Objectives

A. Provide a tool for agency administrators, fire managers, dispatchers, agency cooperators, and firefighters to gauge fire danger ratings within fire suppression areas.
B. Define fire danger rating areas with similar weather, fuels, topography, and fire occurrence within the Southeast Zone (SEZ) dispatch area
C. Describe the current fire weather monitoring network within the SEZ made up of Remote Automated Weather Stations (RAWS).
D. Determine fire business and adjective fire danger rating breakpoints using the Weather Information Management System (WIMS), the National Fire Danger Rating System (NFDRS), FireFamily Plus software, and by analyzing historical climatological data and fire history.
E. Define roles and responsibilities to assist in make fire planning and management decisions, manage weather information, provided weather forecasts, and brief fire suppression personnel.
F. Ensure that agency administrators, fire managers, and cooperating agencies, private industry (ranchers, land owners, utility companies, etc.), and the public are notified of the adjective fire danger rating and local preparedness levels.
G. Make recommendations to personnel outlining specific daily actions to take at each planning level.
H. Develop and distribute fire danger pocket cards to all personnel involved with fire suppression activities.
I. Develop a fundamentally solid Fire Danger Operating Plan that also provides opportunities for improvements and updates.

Roles and Responsibilities

Southeast Zone NFDRS Technical Group

Each Participating agency will be responsible for providing an NFDRS technical specialist to participate in the maintenance, review, and update of the plan. They will provide oversight to insure coordination between the agencies is occurring. The technical group consists of the following agencies and individuals.

Agency	Technical Specialist
SEZ Tucson Interagency Dispatch	Mike Wilke
Coronado National Forest	Chris Stetson
AZ BLM Gila District	Mark Pater
NPS	TBD
USFWS	Sonya Feaster
Tohono O'odham Nation	Guy Acuna

Table 1. SEZ NFDRS Technical Group

Tucson Interagency Dispatch Center

Personnel at SEZ Tucson Interagency Dispatch Center are responsible for WIMS program implementation, station catalog maintenance and the dissemination of the daily fire-danger outputs to the field. The dispatch center will communicate daily, by radio and internet these outputs.

WIMS: NFDRS components and indices are calculated using the NFDRS processor within the Weather Information Management System (WIMS). Fire danger calculations are made daily based on a single observation taken at 1300 hours Local Standard Time (LST). These observations are averaged between four weather stations for the SEZ, Southeast Zone SIG (Special Interest Group – Columbine, Sasabe, Muleshoe, and Saguaro). The dispatch center is responsible for the daily monitoring and editing of inputs.

Station Catalog Maintenance: The Dispatch Center designated personnel is responsible for assuring that station catalog information is reviewed on a yearly basis. Only designated personnel will have edit access to all catalogs and will adjust inputs as necessary after station analysis has been performed by the agency technical specialist.

Communication of Outputs: The afternoon forecast package will consist of the fire weather forecast, today's fire-danger indices and the next day forecasted indices for the SEZ. They will include the following:

1. ERC & BI– today's value and tomorrow's forecasted value.
2. Adjective Rating - today's value and tomorrow's forecasted value.

Duty Officer (FMO's, AFMO's, FOS's)
For purpose of this plan, a Duty Officer is defined at an FMO, AFMO, FOS, or whoever the local unit designates who can provide input and guidance regarding planning and dispatch levels. Duty Officers are responsible for the implementation of this plan; ensuring decisions made are consistent with the intent of the plan. Duty Officers will assure that their personnel understand NFDRS outputs and how to apply them to daily operations. These indices and their implications to the day's operations can be in discussions each morning by all field going personnel as a part of their daily briefings.

Fuel Moisture Monitoring: Each unit conducting fuel moisture monitoring activities within the SEZ is responsible for following the 2004 Southwest Area Fuel Moisture Monitoring Program: Standard Methods and Procedures guide when collecting fuel moisture samples. Each unit is also responsible for following the National Fuel Moisture Database (NFMD) User's Guide when providing data input into the National Fuel Moisture Database. Fuel moisture information can be used in conjunction with current Energy Release Component (ERC) indices to determine adjective fire danger rating levels and provide a basis for severity funding requests.

Unit Fire Program Managers
Unit Fire Program Managers for each cooperating agency in the SEZ will utilize this Fire Danger Operating Plan and NFDRS outputs as a tool in developing appropriate decision matrices to establish appropriate fire related actions. It is the responsibility of the Unit Fire Program Manager to ensure this plan is utilized, maintained, and communicated.

Fire Danger Rating Inventory and Analysis

The Administrative Unit
There are five agencies cooperating in the administrative unit of the analysis area. They are the USFS, NPS, BLM, USFWS and the Tohono O'odham Nation. There is one fire-danger zone within the SEZ. Cooperating agency partners include:

National Park Service:
Saguaro NM: 91,440 acres
Chiricahua NM: 12,984 acres
Fort Bowie NM: 1000 acres
Coronado NM: 4,570 acres
Fort Bowie Nat Historic Site: 999 acres
Organ Pipe Cactus NM: 330,689 acres
Tumacacori Nat Historic Park: 360 acres

Coronado National Forest :
Douglas Ranger District: 433,690 acres
Nogales Ranger District: 352,223 acres
Safford Ranger District: 411,220 acres
Sierra Vista Ranger District: 321,353 acres
Santa Catalina Ranger District: 265,146 acres

BLM Gila District:
Tucson Field Office: 600,000 acres

Safford Field Office: 1.4 million acres

US Fish and Wildlife Service:
Buenos Aires NWR: 118,000 acres
San Bernardino NWR: 2,369 acres

Tohono O'odham Nation: 2.8 million acres

Fire Danger Rating Areas

The Southeast Zone Interagency Fire Danger Planning Area is comprised of two Fire Danger Rating Areas (FDRAs). They are identified as the Sonoran Fire Danger Rating Area and the Basin and Range Fire Danger Rating Area. These zones were identified primarily due to their vegetative, climatic and topographical characteristics.

Sonoran Fire Danger Rating Area

Sonoran FDRA Location

The Sonoran FDRA is located in southern Arizona and comprises the western half of the Southeast Zone (see Map 1a). Federal agencies within this FDRA include Tribal lands, U.S. Fish and Wildlife Service, National Park Service, USFS Coronado National Forest, BLM, military lands, Arizona State and county, and private lands (see Table 2).

Tribal Acres	USFWS Acres	NPS Acres	USFS Acres	BLM Acres	Military Acres	AZ State & County Acres	Private Acres
2,745,424	864,678	346,614	11,975	350,703	26,429	1,151,775	881,264

Table 2. Sonoran FDRA ownership and acres.

Sonoran FDRA Fuels

The Sonoran FDRA supports desert shrub vegetation. The giant saguaro cactus is a widely recognizable species that characterizes the area. Various desert shrub and cactus species indicative of this ecosystem include bursage, desert wolfberry, desert saltbush, desert broom, creosote bush, mesquite, burroweed, ocotillo, cholla, and prickly pear. Bush muhly, Arizona cottontop, threeawns, and fluffgrass are the main understory plants. Winter annuals can grow in some areas, depending on the amount of winter precipitation. Joshua-tree and little-leaf palo verde mixed with some honey mesquite are on stony or rocky sites. These sites have an understory of Mormon tea, prickly pear, cholla, ocotillo, desert saltbush, and grasses. At the lower elevations, creosote bush, ironwood, mesquite, burroweed, and catclaw are associated with an understory of threeawns and annual grasses and forbs.

The National Fire Danger Rating System (NFDRS) fuel models L (Western Perennial Grass) and A (Western Annual Grass) are the most appropriate fuel models for this FDRA when working in WIMS and FireFamily Plus.

LANDFIRE data using 2008 Rapid Refresh FBFM 13 layer shows the predominant Fire Behavior Prediction System (FBPS) Fuel Model as FBPS FM 5 (81% of the FDRA area). FBPS FM 5 is defined as fire being generally carried in the surface fuels that are made up of litter cast by the shrubs and the grasses or forbs in the understory. The fires are generally not very intense because surface fuel loads are light, the shrubs are young with little dead material, and the foliage contains little volatile material. Usually the shrubs are short and almost totally cover the area[i].

Fire Behavior Prediction System Fuel Model 1 is shown as comprising approximately 8% of this FDRA. FBPS FM 1 is defined as fire spread governed by fine, very porous, and continuous

herbaceous fuels that have cured or are nearly cured. Fires are surface fires that move rapidly through the cured grass and associated material. Very little shrub or timber is present, generally less than one-third of the area[ii].

LANDFIRE data using the 2008 Rapid Refresh Scott and Burgan 40 fuel models (FBFM40) layer shows the predominant FBFM40 fuel model GS2 [122] as comprising 79% of the FDRA. The 2008 Rapid Refresh data also shows FBFM40: GR1 [101], GS1 [121] and SH5 [145] as comprising approximately 2%, 3% and 3% of the Sonoran FDRA respectively.

The grass fuel type models (GR) are described as grass being the primary carrier of fire. Grass fuels can vary from heavily grazed grass stubble or sparse natural grass to dense grass stands. Fire behavior varies from moderate spread rates and low flame lengths in the sparse grass to extreme spread rates and flame lengths in the heavier stands of grass. All GR fuel models are dynamic, meaning that their liver herbaceous fuel load shifts from live to dead as a function of live herbaceous moisture content. The effect of live herbaceous moisture content on spread rate and intensity is strong[iii].

The grass-shrub fuel models (GS) are described as grass and shrubs combined being the primary carrier of fire; both components are important in determining fire behavior. All GS fuel models are dynamic, meaning that their herbaceous fuel load shifts from live to dead as a function of liver herbaceous moisture content. The effect of live herbaceous moisture content on spread rate and intensity is strong and depends on the relative amount of grass and shrub load in the fuel model[iv].

The shrub fuel models (SH) describe the primary carrier of fire as live and dead shrub twigs and foliage in combination with dead and down shrub litter. A small amount of herbaceous fuel may be present[v].

Sonoran FDRA Climate

The average annual precipitation is 3 to 10 inches (75 to 255 millimeters) in most of this area. Rainfall can average 22 inches (560 millimeters) per year in the mountain ranges. Most of the rainfall occurs as high-intensity, convective thunderstorms, mainly from July to September, and as Pacific frontal storms from December to March. Snowfall is rare, except at the higher elevations. The average annual air temperature is 58 to 74 degrees F (15 to 23 degrees C). The freeze-free period averages 285 days and ranges from 205 to 365 days, decreasing in length with increasing elevation[vi].

The purpose of understanding climate is to allow the processor to select the proper seasonal response of live fuel moisture predictions. Seasonal response of live fuels is dependent on latitude, elevation, and time of the year which are all a factor of climate. C.W. Thorne Waite's "The Climates of North America According to a New Classification" publication was used to determine the Climate Class for each fire-danger rating area. The SEZ fits Climate Class 1 which represents arid or semi-arid desert or steppe country.

Adjustments of climate class are allowed during the course of the fire season if the observed live fuel characteristics deviate from the model but are not advised. Using actual measured values to manually adjust in WIMS is the preferred alternative. Only measured live fuel moisture values can be edited. All other values are to be left as calculated.

Sonoran FDRA Topography

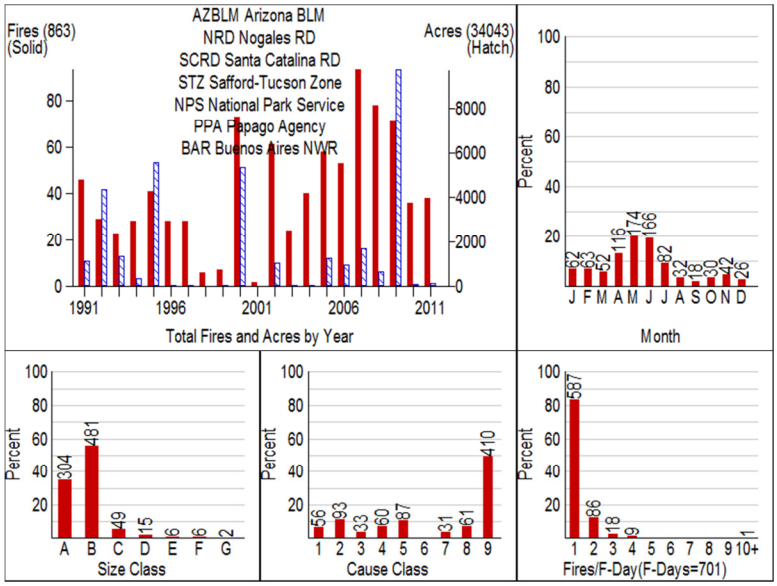
This FDRA is in the Sonoran Desert Section of the Basin and Range Province of the Intermontane Plateaus. This FDRA has a number of short, fault-block mountain ranges trending southeast to northwest rise abruptly from the smooth or gently sloping desert valley floors.

The basic consideration for selecting the slope class is the topography in the base area where initial attack is commonly taken. This is not in the immediate vicinity of the fire weather station.

Precision in estimating slope class is subjective and absolute precision is not necessary. Slope classes within this FDRA are variable (see Map 1b)

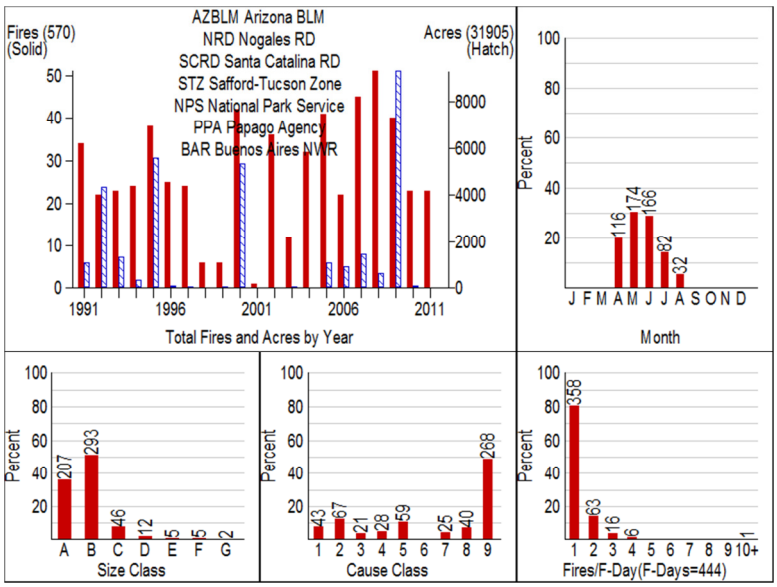
Sonoran FDRA Fire Occurrence

From 1991 through 2011, the Sonoran FDRA recorded 863 fires which burned a total of 34,043 acres. This 20-year timeframe includes all fires recorded between January 1 and December 31 for each year. FireFamily Plus version 4.1.0.0 beta (FFP) was used to compile and analyze fire history data (see Graph 1).

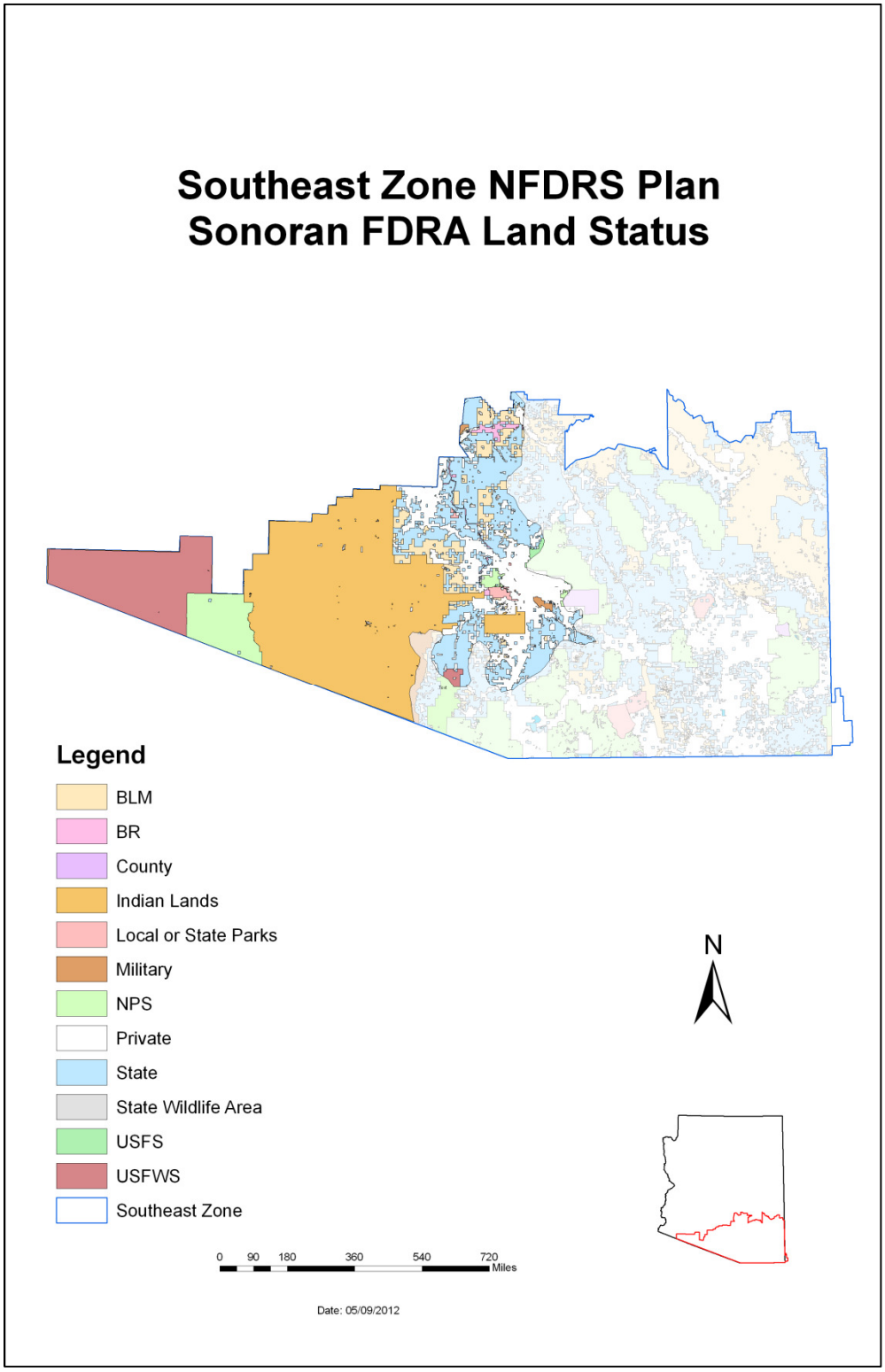


Graph 1. Sonoran FDRA Fire History Summary, 1991-2011, January - December.

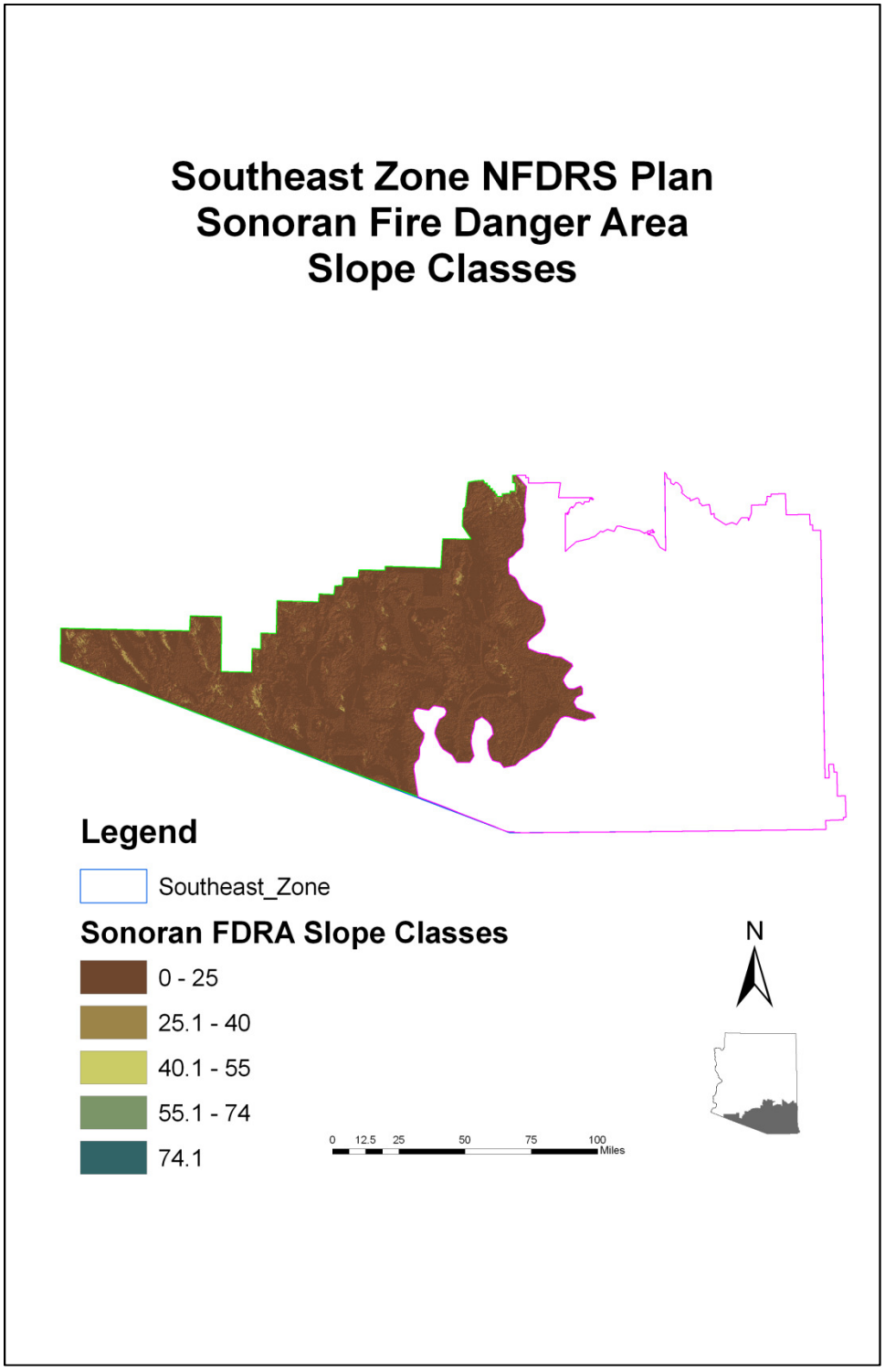
Fire history analyses for this NFDRS plan defined "fire season" to begin on April 1 and end on August 31. For fire seasons from 1991 through 2011, the Sonoran FDRA recorded 570 fires which burned a total of 31,905 acres. Forty three (8%) of these fires were caused by lightning (Cause Class 1); 240 fires (42%) were human-caused (Cause Classes 2-8); 268 fires (47%) were categorized in Cause Class 9 (Unknown) (see Graph 2).



Graph 2. Sonoran FDRA Fire History Summary, 1991-2011, April - August



Map 1a. Sonoran FDRA Land Ownership



Map 1b. Sonoran FDRA Slope Classes

Basin and Range Fire Danger Rating Area

Basin and Range FDRA Location

The Basin and Range FDRA is located in southern Arizona and comprises the eastern half of the Southeast Zone (see Map 2a). Federal agencies within this FDRA include Tribal lands, U.S. Fish and Wildlife Service, National Park Service, USFS Coronado National Forest, BLM, military lands, Arizona State and county, and private lands (see Table 3).

Tribal Acres	USFWS Acres	NPS Acres	USFS Acres	BLM Acres	Military Acres	AZ State & County Acres	Private Acres
76,813	92,478	74,064	1,631,930	1,519,879	108,044	2,897,539	2,603,090

Table 3. Basin and Range FDRA ownership and acres.

Basin and Range FDRA Fuels

The Basin and Range FDRA is comprised of a wide variety of vegetative communities: forest, savanna, and desert shrub vegetation. Pine-oak woodlands are at the higher elevations, where ponderosa pine, Douglas-fir, live oak, New Mexico locust, Mexican pinyon, buckbrush, and manzanita grow along with an understory of muhlys, bluegrasses, sedges, pine dropseed, and squirreltail.

Evergreen woodland savannas are at intermediate elevations, where Mexican blue oak, Emory oak, and turbinella oak are the dominant species and cone beardgrass, sideoats grama, blue grama, Texas bluestem, plains lovegrass, sprucetop grama, threeawns, and needlegrass characterize the understory. Whitethorn, soaptree yucca, fourwing saltbush, mesquite, and ocotillo grow on the drier soils at the lower elevations. The understory on these sites consists of Rothrock grama, black grama, alkali sacaton, curly mesquite, plains bristlegrass, bush muhly, and lemongrass.

The National Fire Danger Rating System (NFDRS) fuel models G (Short Needle [Heavy Dead]) and L (Western Perennial Grass) are the most appropriate fuel models for this FDRA when working in WIMS and FireFamily Plus.

LANDFIRE data using 2008 Rapid Refresh FBFM 13 layer shows the predominant Fire Behavior Prediction System (FBPS) Fuel Models as: FBPS FM 1, FBPS FM 2, FBPS FM5, and FBPS FM8.

FBPS FM1 is primarily located in the lower elevations of this FDRA and is shown as covering approximately 29% of this FDRA. This fuel model is defined as fire spread governed by fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. Fires are surface fires that move rapidly through the cured grass and associated material. Very little shrub or timber is present, generally less than one-third of the area.

FBPS FM2 best fits the intermediate elevations within this FDRA and is shown as covering approximately 13% of the area. This fuel model is described as having fire spread occurring primarily through the fine herbaceous fuels, either curing or dead. These are surface fires where the herbaceous material, in addition to litter and dead-down stemwood from the open shrub or timber overstory, contributes to the fire intensity. Open shrub lands and pine stands or scrub oak stands that cover one-third to two-thirds of the area may generally fit this model; such stands may include clumps of fuels that generate higher intensities and that may produce firebrands. Some pinyon-juniper may be in this model[vii].

FBPS FM 5 best fits some of the low elevation riparian areas and the intermediate elevations of the mountain ranges. This fuel model is shown as covering approximately 10% of this FDRA. FBPS FM 5 is defined as fire being generally carried in the surface fuels that are made up of litter cast by the shrubs and the grasses or forbs in the understory. The fires are generally not very

intense because surface fuel loads are light, the shrubs are young with little dead material, and the foliage contains little volatile material. Usually the shrubs are short and almost totally cover the area.

FBPS FM8 is located in the upper elevations and comprises approximately 40% of this FDRA. This fuel model is described having slow burning surface fires with low flame lengths. The fire may encounter an occasional "jackpot" or heavy fuel concentration that can flare up. Only under severe weather conditions involving high temperatures, low humidities, and high winds do these fuels pose fire hazards. Closed canopy stands of short-needle conifers or hardwoods that have leafed out support fire in the compact litter layer. This layer is mainly needles, leaves, and occasionally twigs because little undergrowth is present in the stand. This model can be used for 1978 NFDRS fuel models H and R[viii].

LANDFIRE data using the 2008 Rapid Refresh Scott and Burgan 40 fuel models (FBFM40) layer shows the predominant FBFM40 fuel models for the lower elevations as being in the grass and grass-shrub categories (GR1 [101], GR2 [102], GS1 [121], GS2 [122]). The intermediate elevations are best described as being in the shrub categories; primarily SH1 [141] and SH7 [147]. The timber understory and timber litter categories best define the upper elevations of this FDRA; primarily TU1 [161], TL3 [183] and TL8 [188]).

The grass fuel type models (GR) are described as grass being the primary carrier of fire. Grass fuels can vary from heavily grazed grass stubble or sparse natural grass to dense grass stands. Fire behavior varies from moderate spread rates and low flame lengths in the sparse grass to extreme spread rates and flame lengths in the heavier stands of grass. All GR fuel models are dynamic, meaning that their liver herbaceous fuel load shifts from live to dead as a function of live herbaceous moisture content. The effect of live herbaceous moisture content on spread rate and intensity is strong[ix].

The grass-shrub fuel models (GS) are described as grass and shrubs combined being the primary carrier of fire; both components are important in determining fire behavior. All GS fuel models are dynamic, meaning that their herbaceous fuel load shifts from live to dead as a function of liver herbaceous moisture content. The effect of live herbaceous moisture content on spread rate and intensity is strong and depends on the relative amount of grass and shrub load in the fuel model[x].

The shrub fuel models (SH) describe the primary carrier of fire as live and dead shrub twigs and foliage in combination with dead and down shrub litter. A small amount of herbaceous fuel may be present[xi].

The timber-understory fuel models (TU) describe the primary carrier of fire as forest litter in combination with herbaceous or shrub fuels. TU1 contains a liver herbaceous load and is dynamic, meaning that the live herbaceous fuel load is allocated between live and dead as a function of live herbaceous moisture content. The effect of live herbaceous moisture content on spread rate and intensity is strong and depends on the relative amount of grass and shrub load in the fuel model[xii].

The timber litter fuel models (TL) describe the primary carrier of fire as dead and down woody fuel. Live fuel, if present, has little effect on fire behavior[xiii].

Basin and Range FDRA Climate

The average annual precipitation is 9 to 20 inches (230 to 510 millimeters) in most of this area, but it is as much as 45 inches (1,145 millimeters) at the higher elevations. More than half of the precipitation occurs as high-intensity, convective thunderstorms during July, August, and September. Because of Pacific frontal storms, a second rainy season occurs from December to March. Snow falls occasionally in winter. The average annual air temperature is 47 to 68 degrees

F (8 to 20 degrees C). The freeze-free period averages 245 days and ranges from 160 to 335 days, decreasing in length with elevation[xiv].

The purpose of understanding climate is to allow the processor to select the proper seasonal response of live fuel moisture predictions. Seasonal response of live fuels is dependent on latitude, elevation, and time of the year which are all a factor of climate. C.W. Thorne Waite's "The Climates of North America According to a New Classification" publication was used to determine the Climate Class for each fire-danger rating area. The SEZ fits Climate Class 1 which represents arid or semi-arid desert or steppe country.

Adjustments of climate class are allowed during the course of the fire season if the observed live fuel characteristics deviate from the model but are not advised. Using actual measured values to manually adjust in WIMS is the preferred alternative. Only measured live fuel moisture values can be edited. All other values are to be left as calculated.

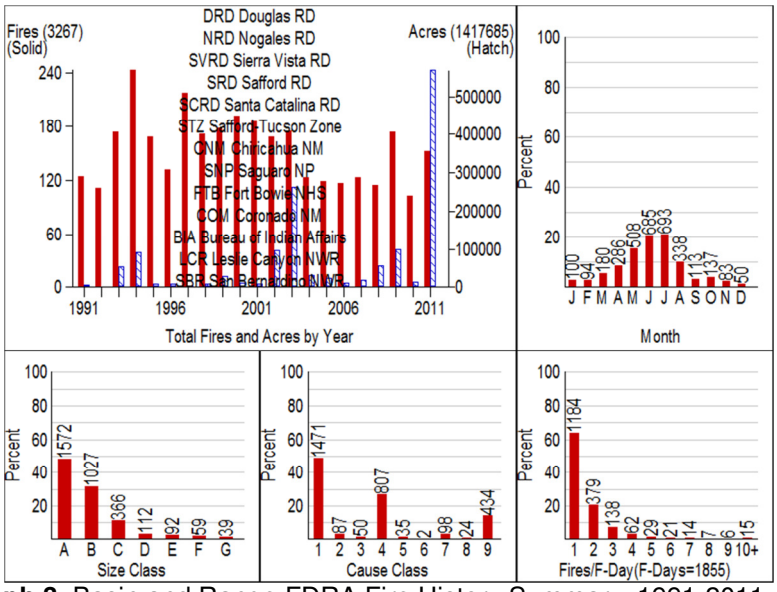
Basin and Range FDRA Topography

This FDRA is characterized is in the Mexican Highland Section of the Basin and Range Province of the Intermontane Plateaus. This FDRA has mountain ranges that trend southeast to northwest and has relatively smooth valleys between the mountains. Examples of these mountain ranges are the Chiricahua, Dragoon, Swisshelm, and Pedregosa Mountains. Elevations range from 2,620 to 4,590 feet (800 to 1,400 meters) in most areas. Elevations generally range from 4,920 to 5,900 feet (1,500 to 1,800 meters) in the mountains. On some peaks, however, the elevation can reach almost 8,900 feet (2,715 meters). The elevation on Mt. Graham reaches 10,717 feet (3,267 meters).

The basic consideration for selecting the slope class is the topography in the base area where initial attack is commonly taken. This is not in the immediate vicinity of the fire weather station. Precision in estimating slope class is subjective and absolute precision is not necessary. Slope classes within this FDRA are variable (see Map 2b)

Basin and Range FDRA Fire Occurrence

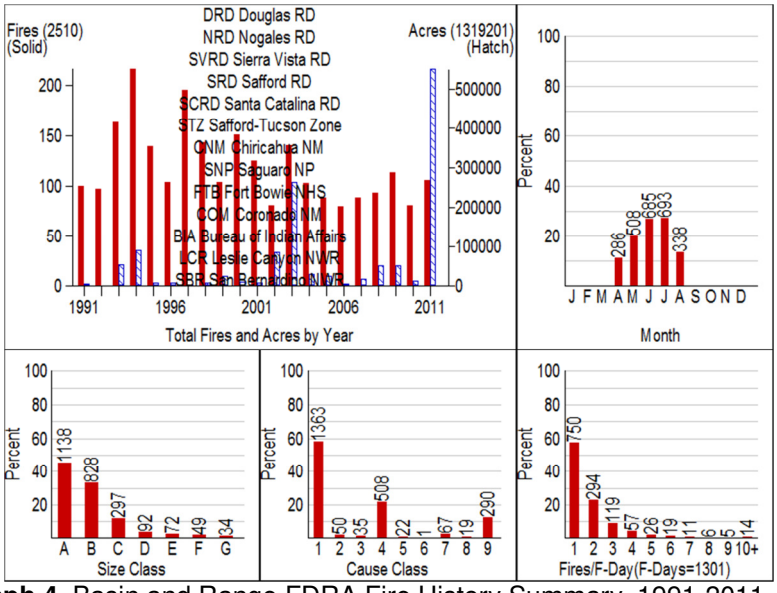
From 1991 through 2011, the Basin and Range FDRA recorded a total of 3,267 fires which burned a total of 1,417,685 acres. This 20-year timeframe includes all fires recorded between January 1 and December 31 for each year. FireFamily Plus version 4.1.0.0 beta (FFP) was used to compile and analyze fire history data (see Graph 3).



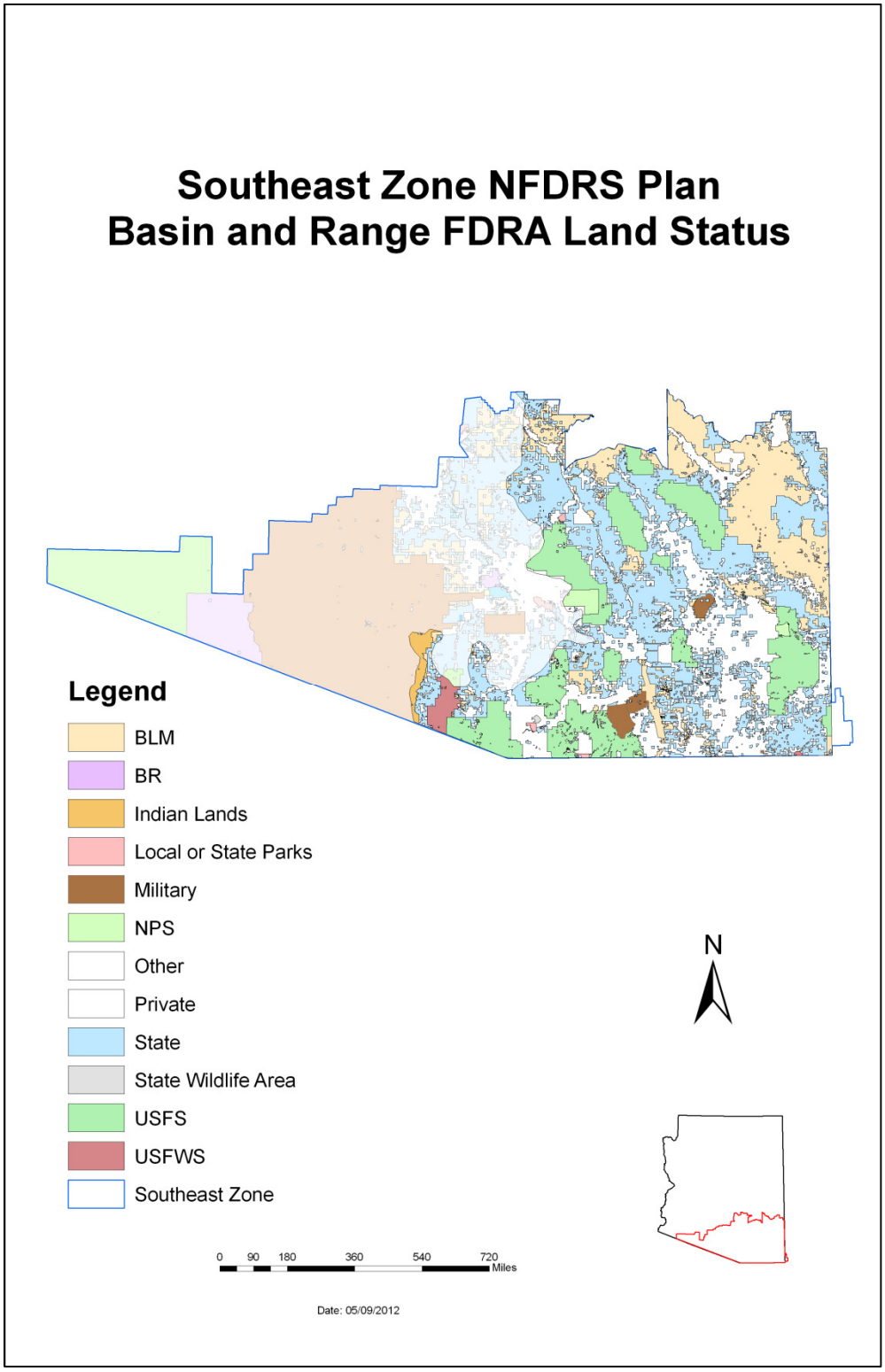
Graph 3. Basin and Range FDRA Fire History Summary, 1991-2011, January - December.

Fire history analyses for this NFDRS plan defined "fire season" to begin on April 1 and end on August 31. For fire seasons from 1991 through 2011, the Basin and Range FDRA recorded 2,690 fires which burned a total of 1,376,033 acres.

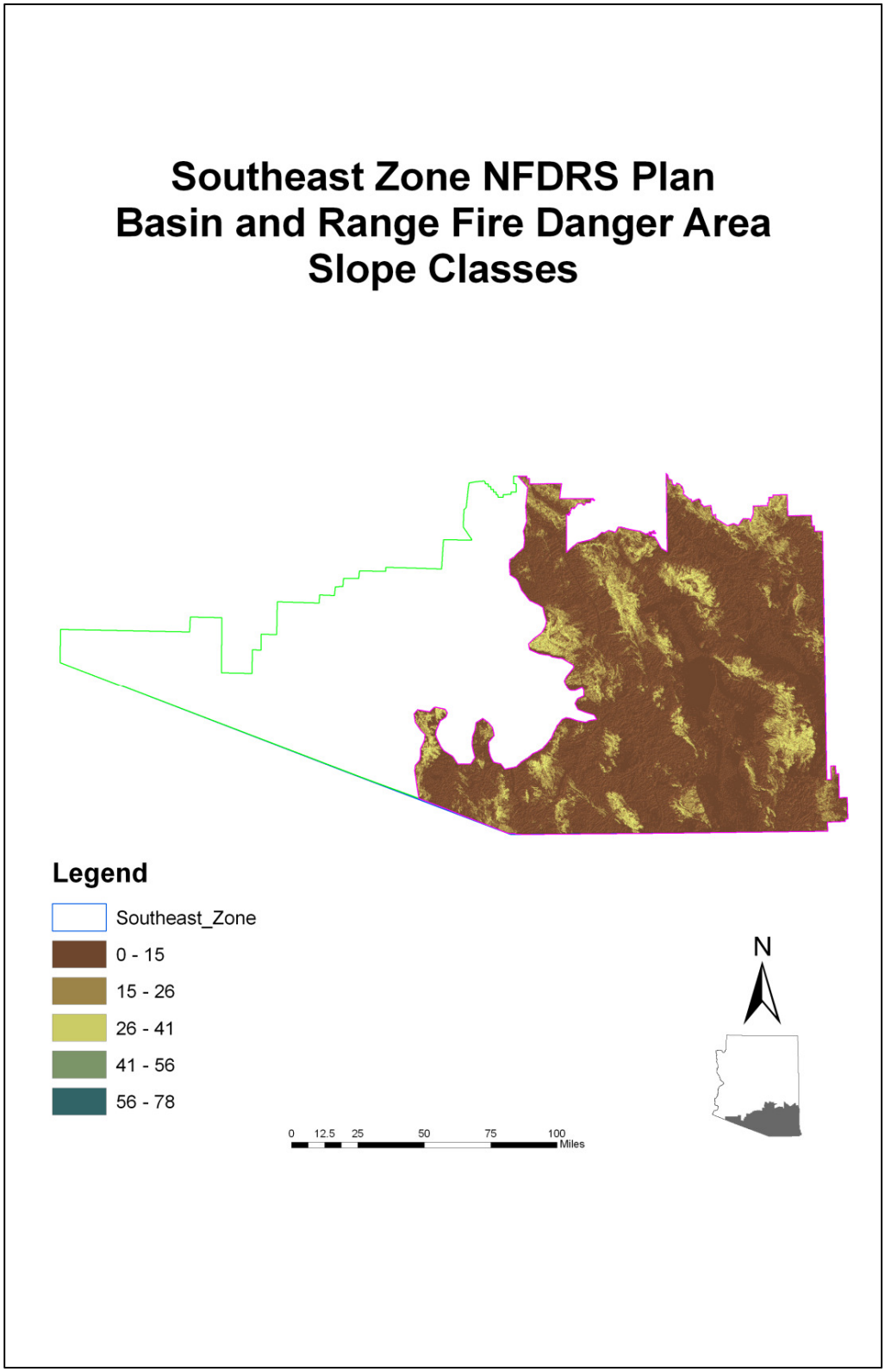
For fire seasons from 1991 through 2011, the Basin and Range FDRA recorded 2,510 fires which burned a total of 1,319,201 acres. Approximately 1,363 fires (58%) were caused by lightning (Cause Class 1); approximately 702 fires (30%) were human-caused (Cause Classes 2-8); 290 fires (12%) were categorized in Cause Class 9 (Unknown) (see Graph 4).



Graph 4. Basin and Range FDRA Fire History Summary, 1991-2011, April - August



Map 2a. Basin and Range FDRA Land Ownership



Map 2b. Basin and Range FDRA Slope Classes

Weather Stations and Data

Remote Automated Weather Stations (RAWS)

The SEZ contains a network of remote automated weather stations (RAWS) (see Map 3). For this plan we are using 12 of those stations (see Table 4). Inclusion in the weather analysis depends primarily upon two criteria: 1) length of record, and 2) data consistency within the period of April to October. Each station was examined and judged upon these two criteria. In addition, two portable weather stations are available for prescribed burning and, if needed, when managing fires for multiple objectives.

Station Name and Responsible Agency	Station #	Elevation (ft)	Latitude & Longitude	Point of Contact
Horse Camp (BLM)	020903	4,040'	N32.9364° / W110.4933°	Mike Wilke
Muleshoe (BLM)	021007	4,560'	N32.4039° / W110.2719°	Mike Wilke
Saguaro (NPS)	021202	2,750'	N32.3184" / W110.8129"	Mike Wilke
Black Hills (BLM)	021008	3,300'	N33.0819° / W109.9511°	Mike Wilke
Guthrie (BLM)	021104	6,340'	N32.8819° / W109.3092°	Mike Wilke
Empire (BLM)	021205	4,650'	N31.7836° / W110.6436°	Mike Wilke
Columbine (CNF)	021005	9,521'	N32.7039° / W109.9139°	Mike Wilke
Noon Creek (CNF)	021010	4,925'	N32.6678° / W109.7881°	Mike Wilke
Rucker (CNF)	021414	5,700'	N31.7611° / W109.3486°	Mike Wilke
Carr (CNF)	021411	5,400'	N31.4450° / W110.2800°	Mike Wilke
Headquarters (NPS)	021409	5,400'	N32.0061° / W109.3569°	Mike Wilke
Sasabe (FWS)	021206	3,500'	N31.6917° / W111.4481°	Rod Lopez

Table 4. Primary Weather Stations for the Southeast Zone

WIMS Management

Designated personnel within the Southeast Zone will be responsible for station catalog maintenance for FDRA stations. Dispatchers will enter observations daily as scheduled. They will monitor for accuracy and inform personnel responsible for station maintenance when it appears that a station or sensor is not functioning properly. The designated personnel will ensure that stations are greened up, cured, and frozen at the proper times. Every three years the Technical Specialist will analyze data to update station catalog breakpoints whenever the breakpoints are adjusted.

RAWS Station Maintenance and Quality Assurance

RAWS will be maintained according to National Standards. Designated individuals within the TDC will be responsible for tracking the annual station maintenance. All field maintenance should be completed annually. Each station has a Point of Contact (POC) (Exhibit 8) with the responsibilities of carrying out the yearly station maintenance and to fix any problems that arise during the season. The minimum qualifications for a first responder are to have attended a RAWS station maintenance course. The stations' metadata will be kept up-to-date and monitored.

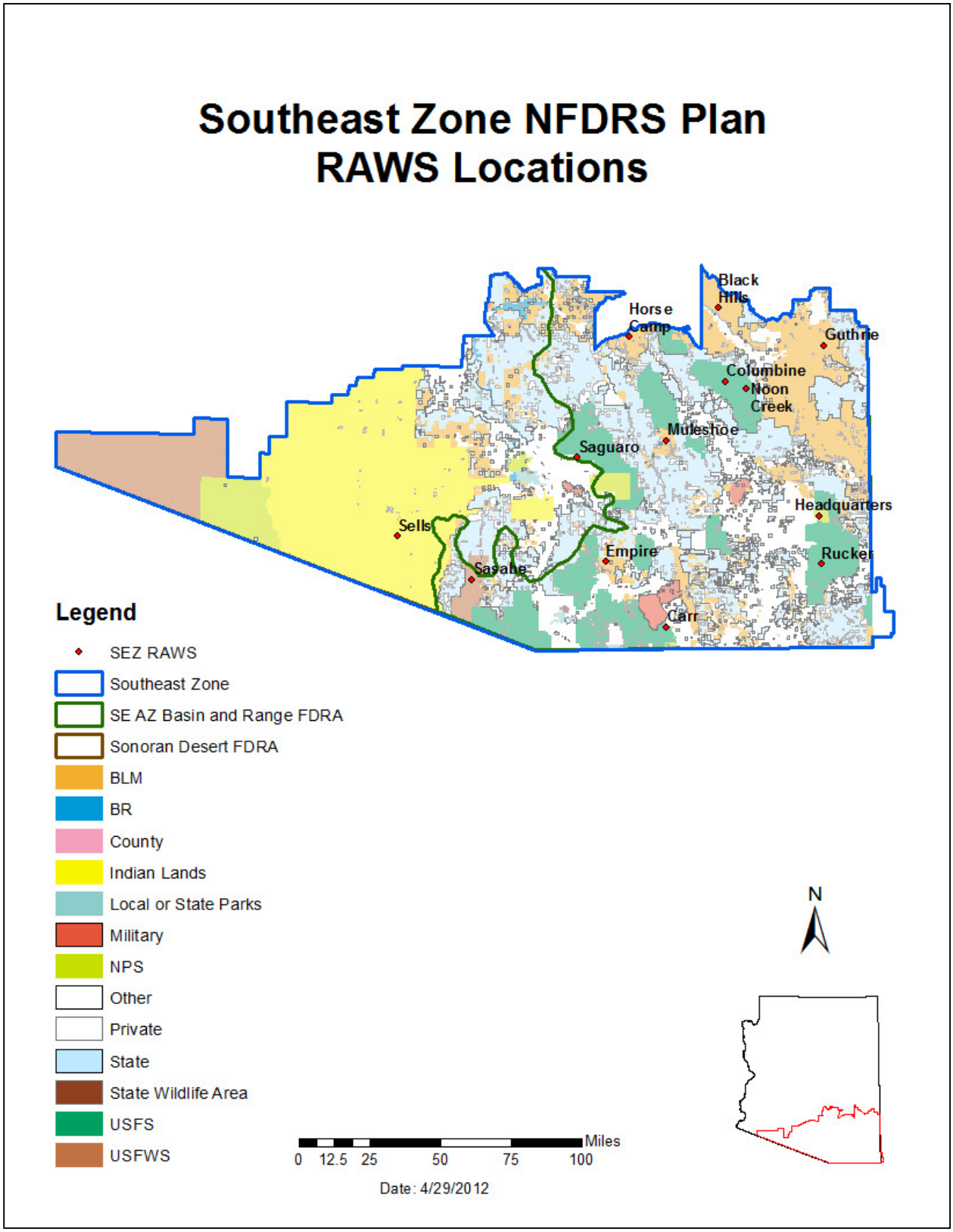
Daily Fire-Danger Rating Processes

The Tucson Interagency Dispatch Center is responsible for the daily monitoring and editing of all weather station and site inputs and the fire-danger outputs for the NFDRS. This information is to be disseminated to the field during the morning and afternoon fire weather forecast package. This process includes:

1. Morning - Read over the radio today's fire weather forecast and forecasted fire-danger indices for the day.
2. Afternoon - Edit in WIMS the State of the Weather (SOW) and measured live woody fuel moisture values daily.
3. Review all other inputs from station sensors for accuracy and to assure that no station observations are missing. Fix all missing or inaccurate data in WIMS as soon as possible.

4. Review all outputs from WIMS for accuracy.
5. Afternoon – Read over the radio the afternoon fire weather forecast and the forecasted fire-danger indices for the next day.
6. Review the fire-danger rating forecasts posted on the Southwest Coordination Center (SWCC) Outlook page to insure accuracy (http://gacc.nifc.gov/swcc/predictive/outlooks/outlooks.htm).

Accuracy and storage of the daily weather data is critical for reliable outputs and future analysis. Training for persons responsible for inputting and editing weather observations and station maintenance are essential elements to maintain high-quality data going into the NFDRS calculations. Personnel responsible for these edits must have attended or edits reviewed by someone who has attended the S-491 National Fire Danger Rating System training.



Map 3. Southeast Zone Remote Automated Weather Station (RAWS) locations.

Fire Danger Indices and Fire Business

Information Collection, Correlation and Interpretation

1. The fire weather history is created using a quality control process resulting in the most consistent, historic weather data available. Weather and fire history data from 1991 – 2011 was imported into FireFamily Plus version 4.1.0.0 beta.
2. One Special Interest Group (SIG) was created for each FDRA. The Sonoran SIG uses the Sells, Saguaro and Sasabe RAWS stations. The Basin and Range SIG incorporates the Columbine, Muleshoe, Empire, and Rucker RAWS stations.
3. Cumulative Fires Analysis graphs were used to identify the best fit by looking for the best separation between Fire Days, Large Fire Days, and Multiple Fire Days using the assigned index and fuel model. The large fire day size was 25 acres and multiple fire days were 3+.
4. The Fire Danger Index that generally has the best fit for the Sonoran FDRA is the Burning Index (BI). The NFDRS fuel model that best represents this FDRA is Fuel Model L (Western Perennial Grasses)
5. The Fire Danger Index that generally has the best fit for the Basin and Range FDRA is the Energy Release Component (ERC). The NFDRS fuel model that best represents this FDRA is Fuel Model G (Dense Conifer with Ground Litter and Heavy Fuels).
6. Live Fuel Moisture also plays a major part in the potential of fire. Vegetative "Greenness" influences fire spread. The greener the vegetation, the lower the fire spread potential. Live fuels consist of: conifer needles; twigs and leaves of shrubs (evergreen and deciduous); and green (live) grasses and forbs. Changes in live fuel moisture content are related to the physiological activity of the vegetation, and this activity is greatly influenced by soil moisture and the soil and air temperature. When precipitation is deficient, less new growth is produced and peak moisture in the living material can be less than during more moist years. If soil moisture deficiency persists through the summer, live fuel moisture can drop more rapidly.
7. Soil and air temperatures affect the time new growth starts and the level of moisture attained by the vegetation. In situations when soil moisture is not limiting, new growth will start earlier and often reach a higher level of moisture when the weather in late winter and spring is warm than when the weather is cold. Other factors that affect soil and air temperatures, such as slope, aspect, and elevation also affect the amount of new growth, the timing of growth, and the level of moisture in the living material.
8. Live plants may either suppress combustion or contribute to it, depending on their moisture content and flammability of chemical compounds contained in the plant. The NFDRS uses weather variables to estimate the moisture content of shrubs and herbaceous plants. These are then used in calculating the ignition component, spread component and energy release component. However, previous experience has shown that moisture content in live vegetation is controlled by species physiology and time of year and may not be accurately calculated from such external variables.

Preparedness Level Breakpoints

A breakpoint is a threshold which corresponds to a change in historical fire activity. Preparedness levels differ from adjective fire danger ratings in that preparedness levels consider fire history in association with historical weather data. FireFamily Plus software was used to establish fire business breakpoints (see Table 5). Statistical analyses based on historical weather adjusted for historical fire activity determines the appropriate staffing level index and associated breakpoints for each FDRA (see Appendix A).

The final preparedness level determination will also incorporate fire activity, fire weather advisories, Haines Index, and a measure of ignition risk. Daily index values will be obtained from WIMS and utilized in preparedness and dispatch level worksheets.

Preparedness Level: FireFamily Plus Analysis Factors and Determinations							
Rating Area	**SIG/RAWS**	**Data Years Used**	**Weighting Factor**	**Fuel Model**	**NFDRS Index**	**Fire Business Breakpoint Ranges**	
Sonoran FDRA	SIG: Sasabe Sells Saguaro	 1991-2011 2002-2011 1991-2011	 1 0.5 1	L	BI	PL1 PL2 PL3 PL4 PL5	0 – 17 18 – 35 36 – 71 72 – 81 82 - 108
Basin and Range FDRA	SIG: Columbine Muleshoe Empire Rucker	 1991-2011 1991-2011 1991-2011 1991-2011	 1 1 1 1	G	ERC	PL1 PL2 PL3 PL4 PL5	0 – 23 24 – 47 48 – 94 95 – 100 101 - 106

Table 5. Fire Business Breakpoint Analysis Results using FireFamily Plus.

Dispatch Level Breakpoints

Wind can factor significantly in regard to large fire growth throughout the Southeast Zone. Therefore, Burning Index (BI) is considered as an appropriate index for establishing dispatch levels for the SEZ. FireFamily Plus categorized the days and large fires appropriately based on an analysis of historic fire activity (see Table 6).

Southeast Zone Dispatch currently utilizes SWCC's Southwest Area 7-Day Significant Fire Potential Outlook (http://psgeodata.fs.fed.us/7day/action/forecast/6) to aid decision making in regard to the number and types of resources needed to initially respond to an incident. Dispatch decisions regarding initial attack resources within the Sonoran FDRA will also include Burning Index (BI) to help guide decisions for appropriate resource response.

Dispatch Level: FireFamily Plus Analysis Factors and Determinations							
Rating Area	**SIG/RAWS**	**Data Years Used**	**Weighting Factor**	**Fuel Model**	**NFDRS Index**	**Climatological Breakpoint Ranges**	
Sonoran FDRA	SIG: Sasabe Sells Saguaro	 1991-2011 2002-2011 1991-2011	 1 0.5 1	L	BI	Low Moderate High Very High Extreme	0 – 17 18 – 35 36 – 71 72 – 81 82 - 108
Basin and Range FDRA	SIG: Columbine Muleshoe Empire Rucker	 1991-2011 1991-2011 1991-2011 1991-2011	 1 1 1 1	G	BI	Low Moderate High Very High Extreme	0 – 24 25 – 49 50 – 99 100 – 112 113+

Table 6. Climatological Breakpoint Analysis based on BI.

Adjective Fire Danger Rating Breakpoints

Adjective fire danger breakpoints are based on staffing classes (divisions of fire danger) and a staffing index component (BI or ERC). An adjective rating will be based upon the seasonal climatic breakpoints. Climatological breakpoints are points on the cumulative distribution of one fire weather/fire danger index without regard to associated fire occurrence/business. For example, the value of the 90th percentile ERC is the climatological breakpoint at which only 10 percent of the ERC values are greater. The percentiles for climatological breakpoints are predetermined by agency directive. The BLM uses the 80th and 95th percentiles; The USFS uses the 90th and 97th percentiles. The Sonoran FDRA will use the 80th and 95th percentiles (see Table 7a) and the Basin and Range FDRA will use the 90th and 97th percentiles (see Table 7b) for adjective fire danger ratings. These values will be entered into WIMS.

In 1974, the Forest Service, Bureau of Land Management and state forestry organizations established a standard adjective description for five levels of fire-danger for use in public information releases and fire prevention signing. For this purpose only, fire danger is expressed using the adjective levels and color codes are described in Appendix B. In 2000, the NWCG Fire Danger Working Team reviewed and slightly revised these terms and definitions for adjective fire-danger.

Sonoran FDRA Input Information			Staffing Class and Percentile Breakpoints	
RAWS	**Fuel Model**	**Staffing Index**	**80th**	**95th**
Sasabe (021206)	L	BI	65	83
Sells (021209)	L	BI	70	90
Saguaro (021202)	L	BI	67	81
SIG: Sonoran	L	BI	64	78

Table 7a. Percentile Breakpoints for the Sonoran FDRA based on BI.

Basin and Range FDRA Input Information			Staffing Class and Percentile Breakpoints	
RAWS	**Fuel Model**	**Staffing Index**	**90th**	**97th**
Columbine (021005)	G	ERC	83	92
Muleshoe (021007)	G	ERC	104	109
Empire (021205)	G	ERC	97	103
Rucker (021414)	G	ERC	103	108
SIG: Basin & Range	G	ERC	94	101

Table 7b. Percentile Breakpoints for the Basin and Range FDRA based on ERC.

Applications

The National Fire Danger Rating System (NFDRS) utilizes the Weather Information Management System (WIMS) processor to manipulate weather data and forecasted data stored in the National Interagency Fire Management Integrated Database (NIFMID) to produce fire danger ratings for corresponding weather stations (RAWS). NFDRS outputs from the WIMS processor can be used to determine various levels of fire danger rating. The system is designed to calculate worst-case scenario fire danger.

NFDRS will be utilized in three ways for the purpose of this plan: the **Preparedness Level**, which will help agency personnel determine an appropriate state of readiness of suppression resources; the **Dispatch Level** is a function of the Burning Index, and is a decision tool for dispatchers to assign initial attack resources to reported fires; the third utilization of NFDRS is to compute the **Adjective Fire Danger** for the purpose of communicating fire danger to the public.

Specific Action and Staffing Guide

Within the SEZ, the staffing level is based on an analysis of cumulative frequency of occurrence of the most current calculated Energy Release Component (ERC) using NFDRS Fuel Model G. Staffing levels are expressed as numeric values where “1” represents the low end of the fire danger continuum and “5” represents the high end (see Appendix D). The ERC percentile values based on fire season data are used for staffing levels and adjective fire danger rating (Interagency Standards for Fire and Aviation Operations, Chapter 10 – Preparedness[xv]).

Preparedness Level

The preparedness level is a five-tier (1-5) fire danger rating system that will be based on the ERC and indicators of fire business. The fire business indicators used to calculate the preparedness level includes an indication of fire activity, the SWA 7-Day Significant Fire Potential Outlook (http://gacc.nifc.gov/swcc/predictive/outlooks/outlooks.htm), Haines Index, and a measure of Ignition Risk. A worksheet can guide personnel through the process (see Appendix C). Several procedures and guidelines are to be followed once the preparedness level has been determined. The breakpoints for the planning level are set using an historical analysis of fire business in FireFamily Plus and its relationship to 1300 RAWS observations entered into the NIFMID database and processed by WIMS which calculates the staffing index values (BI, IC, SC, ERC, etc.).

Worksheet Instructions (optional):

1. **Staffing Index Value:** Place a checkmark in row one indicating the forecasted staffing index/component range. These indices are based on the 1300 RAWS observations which are input to the WIMS processor by Tucson Dispatch Center (TDC) personnel.

2. Haines Index: Place a checkmark in row two indicating the forecasted Haines Index Range.

3. **Southwest Area 7-Day Significant Fire Potential Outlook:** Place a checkmark in row three based on the presence of a High Risk Day (http://gacc.nifc.gov/swcc/predictive/outlooks/outlooks.htm).

4. **Ignition Risk:** Place a checkmark in row four to indicate the relative risk of human and/or naturally caused ignitions. Human-caused risk is based upon activities such as holidays or special events occurring within the FDRA. During holidays (i.e. Memorial Day, Independence Day, Labor Day), the ignition risk is “High” otherwise it is “Low”. The ignition risk will also be set at “High” on the day before and after each of the above-listed holidays. Lightning Activity Level (LAL) would be the basis for relative risk for natural ignitions; a forecasted LAL of 4-6 is a “High” ignition risk, everything else is “Low”. If multiple LAL’s are forecasted within the FDRA, use the “High” risk level to complete the worksheet on row four.

5. **Fire Activity:** Fire activity will be “Yes” if approximately 50% of the suppression resources within the Tucson Interagency Dispatch Area (regardless of FDRA) are committed or responding to a fire. This may be revised if there is significant change in fire activity between the time the initial calculation is made (approximately 1500 hours) and when the Situation Report is due for submission to the Southwest Coordination Center (approximately 1900 hours). Place a checkmark in the appropriate box in row five.

Adjective Fire Danger Rating Determination

NFDRS processors automatically calculate the adjective class rating. The adjective rating calculations are keyed off the first priority fuel model listed in the station record in the processor. It uses the staffing index (i.e. ERC or BI) the user associates with the first fuel model/slope/grass type/ climate class combination.

The actual determination of the daily adjective rating is based on the current or predicted value for a user-selected staffing index and ignition component using the table below (Table 8). An Adjective Fire Danger Rating Matrix can be applied by comparing the Staffing Level with the current Ignition Component, at the point where the two intersect is the Adjective Fire Danger Rating. Given the same weather inputs, the NFDRS processor will calculate the adjective fire danger for selected fuel models.

Staffing Levels	Adjective Fire Danger Rating				
1-, 1, 1+	L	L	L	M	M
2-, 2, 2+	L	M	M	M	H
3-, 3, 3+	M	M	H	H	VH
4-, 4, 4+	M	H	VH	VH	E
5	H	VH	VH	E	E
Ignition Component	0-20	21-45	46-65	66-80	81-100

Table 8. Adjective Fire Danger Rating Matrix.

The adjective fire danger ratings for the Sonoran FDRA is a weighted average of weather observations between the Sasabe (021206), Saguaro (021202) and Sells (021209) RAWS. A Special Interest Group (SIG) has been created in WIMS that combines the data from these three stations using the first priority NFDRS fuel model from each station catalog. The data is accessed using the WIMS "DAVG" command and entering the SIG name in the query box. If a forecasted adjective fire danger rating is required, enter "F" in the "Type" query block. The adjective fire danger rating for the Basin and Range FDRA is determined by querying the SIG of Columbine (021005), Muleshoe (021007), Empire (021205), and Rucker (021414) RAWS.

Seasonal Risk Analysis

Seasonal risk analysis is a comparison of the historic weather and fuels records with current and forecasted weather and fuels information. Seasonal risk analysis is a continuous responsibility for fire program managers. The most reliable indicators of seasonal fire severity have been measurements of fine fuel loading, live fuel moisture, 1,000-hour (dead) fuel moisture, and ERC. Current values will be compared to the historical maximum and minimum values as well as the historical averages. Graphs will be routinely updated and made available to fire suppression and dispatch personnel. Seasonal risk analysis information will be used as a basis for pre-positioning critical resources, dispatching resources, and requesting fire severity funding.

Key Factors and Trends

Fire Activity: The presence (or absence) of fire activity can be tracked and compared to historical occurrences in order to anticipate severity conditions. The Fire Summary module in FireFamily Plus provides an efficient means to compare monthly fire activity.

Live Fuel Moisture: Live fuel moisture plots have been established by the USFS and BLM in the SEZ. Valuable data has been collected and a direct correlation can be concluded between fire intensity (controllability) and live fuel moisture levels. Consequently, fire severity is determined by comparing current trends to historical averages. Species for fuel moisture sampling within the SEZ include: one-seed juniper, alligator bark juniper, scrub oak, Emory oak, Arizona white oak, pinyon pine, and manzanita. Comparisons of fuel moisture to historical conditions at various locations within the SEZ and surrounding areas can be located on the Southwest Coordination Center website: http://gacc.nifc.gov/swcc/predictive/fuels_fire-danger/fuels_fire-danger.htm.

Fine Fuel Loading: Fuel load samples are taken on an annual basis and compared to historical averages in order to determine the potential intensity of wildland fires in NFDRS fuel models A and L. Each agency that collects fine fuel loading data will e-mail the information to all members of the SEZ FMO group to be distributed to all fire personnel. The data will also be made available for posting on the Southeast Zone Interagency Fire website.

NFDRS Indicators: ERC and BI are used as the primary indicators to track seasonal trends of fire danger potential. NFDRS fuel models G has been chosen due to its applicability with ERC within the Basin and Range FDRA. Fuel model L has been chosen for its appropriate applicability to BI within the Sonoran FDRA. Consequently, the fuel

models were selected due to their ability to predict fire occurrence; specifically on a day when a large fire is likely to occur.

Weather Trends: Seasonal weather assessments rely upon long-range (30-90 day) forecasts. This information is available in two formats: seasonal long-term outlooks and 30-90 day outlooks. This information is provided by the NOAA Climate Prediction Center: http://www.cpc.ncep.noaa.gov/

Drought Indicators: ERC and its component 1,000-hour fuel moisture has been proven in the western U.S. to be the most effective way to track seasonal drought and its effect on fire business and risk. The Keetch-Byrum Drought Index (KDBI) and the Palmer Drought Index track soil moisture and do not accurately correlate with fire risk in the western U.S. although the general public is more familiar with these indices for providing drought information. Current KDBI information is located on the Wildfire Assessment System (WFAS) website: http://www.wfas.net/. Tracking and comparing 1,000-hour fuel moisture is another method to assess drought conditions.

Normalized Difference Vegetation Index (NDVI): NDVI data is satellite imagery which displays vegetative growth and curing rates of live fuels. The WFAS website provides several different ways to analyze current and historical greenness imagery which can be a significant contributor to seasonal risk assessments.

Season Ending Events: Although fire season in the SEZ can last all year, fire activity tends to trend downward as days get shorter, average temperatures decline and RH recovery improves in the fall. "Season End" does not mean that fires cannot start and spread but that large fires are improbable.

"Season End" for the Sonoran FDRA was determined by examining each usable year's ERC curve to determine when the ERC dropped below the 75th percentile and recorded daily precipitation over a 3-day period was equal to or greater than the 90th percentile. Utilizing the Term Module in the Rare Event Risk Assessment Process (RERAP) software, the Weibull waiting time distribution was developed from historical season slowing dates based on the criteria defined above (see Appendix E).

"Season End" for the Sonoran FDRA was determined by examining each usable year's ERC curve to determine when the ERC dropped below the 75th percentile and recorded daily precipitation over a 3-day period was equal to or greater than the 90th percentile. Utilizing the Term Module in the Rare Event Risk Assessment Process (RERAP) software, the Weibull waiting time distribution was developed from historical season slowing dates based on the criteria defined above (see Appendix E).

Pocket Cards and Development

At a minimum, Pocket Cards need to directly relate to daily operations and indices with which people are familiar. That is, the fuel model and fire danger rating index must be the same as what is referred to in daily briefings and weather reports. If possible, the fuel model and index should be selected through a fire business analysis using FFP software. Because the card is meant to enhance situational awareness and firefighter safety, whatever fuel model and index are used, they need to be defined and rigorously supported with daily information to the field.

FireFamily Plus software allows users to overlay two years for comparison of fire danger conditions. One should be a year with relatively high fire danger and the other with low fire danger. Both years should be recent, to give the local firefighter a point of reference.

A Pocket Card (PC) will be developed for each FDRA within the Southeast Zone. The Basin and Range FDRA will use the NFDRS Fuel Model G, and the NFDRS Energy Release Component

(ERC) index. NFDRS fuel model G is widely used to display ERC as it contains all of the dead size class fuels and both the herbaceous and woody live fuels (see Exhibit 1).

The Energy Release Component (ERC) is a calculated output of the National Fire Danger Rating System (NFDRS). The ERC is a number related to the available energy (BTU) per unit area (square foot) within the flaming front at the head of a fire. The ERC is considered a composite fuel moisture index as it reflects the contribution of all live and dead fuels to potential fire intensity. As live fuels cure and dead fuels dry, the ERC will increase and can be described as a build-up index. The ERC has memory. Each daily calculation considers the past 7 days in calculating the new number. Daily variations of the ERC are relatively small as wind is not part of the calculation.

The Sonoran FDRA will use NFDRS Fuel Model L and the NFDRS Burning Index (BI). Fuel Model L is the most appropriate NFDRS model to use in the Sonoran FDRA. Burning Index is used to help with the daily fire-danger rating because it uses a wind component (see Exhibit 2).

The Burning Index (BI) is a number related to the contribution of fire behavior to the effort of containing a fire. The BI (difficulty of control) is derived from a combination of Spread Component (how fast a fire can spread) and the Energy Release Component (how much energy can be released). In this context, BI is related to flame length which, in the Fire Behavior Prediction System, is based on rate of spread and heat per unit area. The BI is an index that rates fire danger in relation to potential flame length over a fire danger rating area.

The BI is expressed as a numeric value related to potential flame length in feet multiplied by a factor of 10. The scale is open-ended which allows the range of numbers to adequately define fire control problems even during low to moderate fire danger levels. It is important to remember that a computed BI value is an index representing the near upper limit to be expected within the rating area. In other words, if a fire occurs in the worst fuel, weather and topography conditions somewhere in the rating area, these numbers represent the potential fireline intensity and flame length. These conditions are not expected to represent the entire FDRA at any one time or under less severe conditions.

SEZ Pocket Cards will be evaluated and updated each year, prior to fire crews working in the field environment. It is recommended that each station have a board to track current indices. FireFamilyPlus 4 (FFP) will be used to create the Pocket Cards.

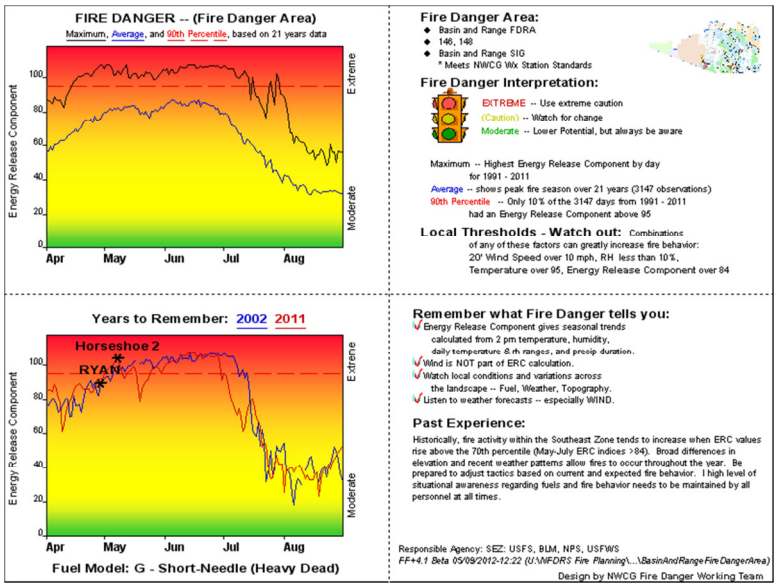


Exhibit 1. Basin and Range Pocket Card using the ERC index.

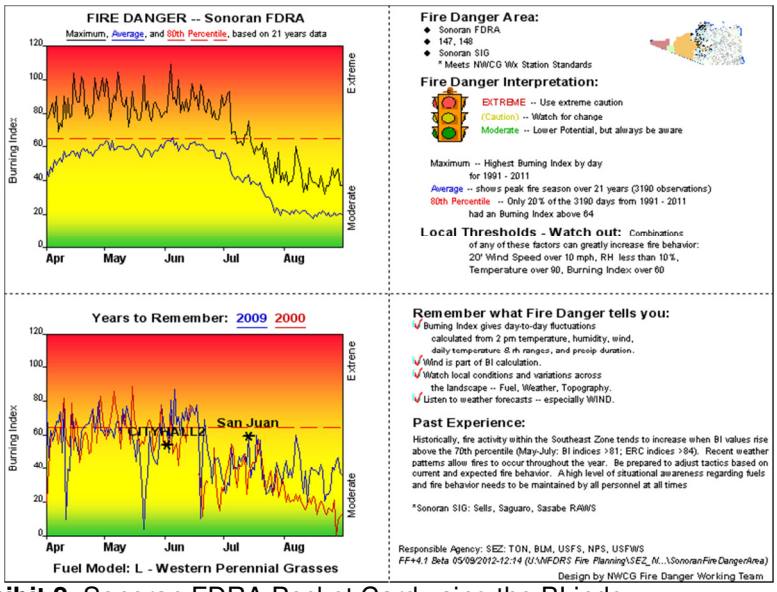


Exhibit 2. Sonoran FDRA Pocket Card using the BI index

Seasonal Risk Analysis and Severity Funding

Seasonal Risk Analysis

A Seasonal Risk Analysis (SRA) requires SEZ fire managers to review current and predicted weather and fuels information, compare this information with historic weather and fuels records, and predict the upcoming fire season's severity and duration for any given area.

Information from a SRA can be used to augment the SEZ Fire Danger Operating Plan (FDOP), step-up and pre-attack plans. It provides the basis for actions such as prepositioning critical resources, requesting additional funding, or modifying Memoranda of Understanding (MOU) to meet anticipated needs.

SRA's for the Southwest Geographic Area are prepared, issued, and updated each year by SWCC (Southwest Coordination Center) Predictive Services staff. These analyses consider detailed information for each of the Predictive Services Areas (PSA) within the Southwest Geographic Area.

Each fire manager within the SEZ will review this comparison update as well as the 7-day Southwest Area forecast and monthly Southwest Area outlook and post this information in dispatch and crew areas. See:

http://psgeodata.fs.fed.us/7day/action/forecast/6
http://gacc.nifc.gov/swcc/predictive/outlooks/monthly/swa_monthly.pdf

If the SRA suggests an abnormal fire season might be anticipated, a unit should notify the state/regional office and request additional resources commensurate with the escalated risk (see Fire Severity Funding below). Each respective agency within the SEZ can calculate their own current and expected fire severity indices using FFP.

Special Orders and Closures - Restrictions

During times of high fire danger within the SEZ, restrictions and/or closures may be imposed to mitigate the risk of wildland fires. Emergency closures have a substantial impact on the public and are only used under the most severe conditions. All Special Orders and Closures will be coordinated with local cooperators and regional agencies.

The SEZ fire managers will make recommendations to their respective agency administrators for the approval of restrictions and/or closures. Those restrictions and/or closures recommendations will follow the guidelines outlined in the Southwest Area Interagency Fire Restrictions and Closures Toolbox and will be implemented in the interest of public safety (http://gacc.nifc.gov/swcc/swcg/committees/information_prevention/documents/restrictions_toolbox/SW_%20INTERAGENCY_FIRE_RESTRICTIONS_CLOSURES_TOOLBOX_2-2011.pdf).

Program Needs

New weather station sites and hardware needs; installation priorities
All stations are in working order at this time. Continued annual maintenance will be the primary issue. Some stations may need to be revaluated as to their location for better wind monitoring.

- Evaluate the need for establishing a permanent station near Cloverdale in the Peloncillo Mountains.
- Evaluate the need for establishing a permanent station in or near the San Simon Valley.
- Evaluate the need for establishing a permanent station in the Sonoran FDRA.

Data Quality:
Fire reporting data quality is critical to ensuring accurate historical fire occurrence analyses. FMOs need to ensure that the information on fire reports submitted to the national database is accurate and complete.

Dispatch:
It is recommended that the Southeast Zone develop standardized dispatch procedures and protocols (e.g. WildCAD run card system) to ensure effective mobilization of suppression resources.

Southeast Zone Partnerships:
It is recommended that the SEZ continues to work towards integrating Arizona State fire managers and suppression resources into the SEZ NFDRS planning process.

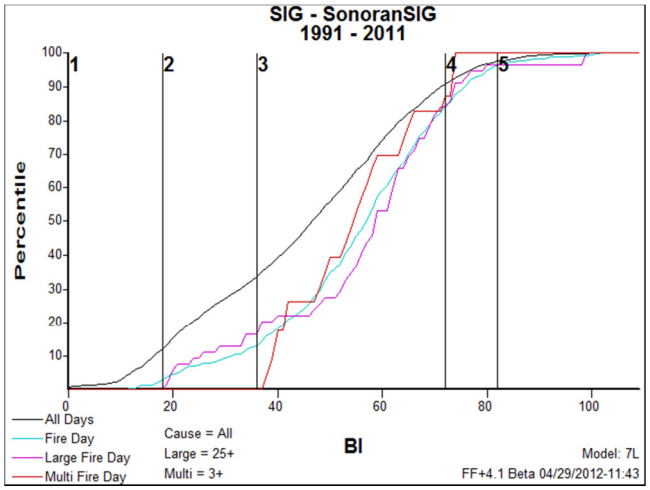
NFDRS Training Needs
It is recommended that dispatchers and Field Operations Managers/FMO's/AFMO's attend S-491 course. Field Operations Managers/FMO's/AFMO's should consider attending the Advanced National Fire Danger Rating course. Field personnel will be trained at the annual fire refreshers on the use of the pocket cards and given a basic understanding of NFDRS.

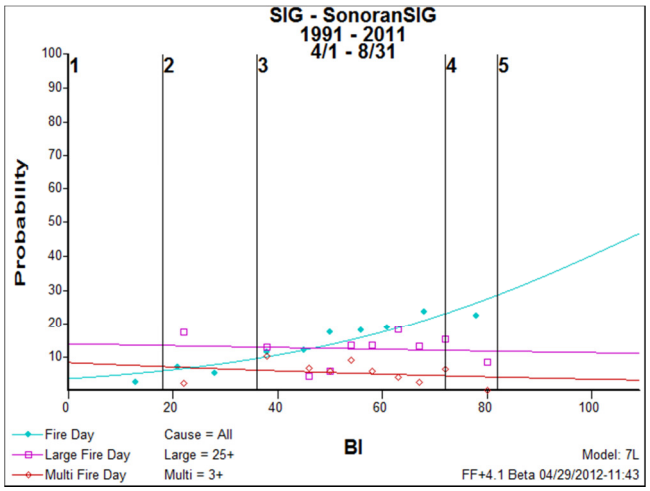
Annual Plan Maintenance and Suggestions

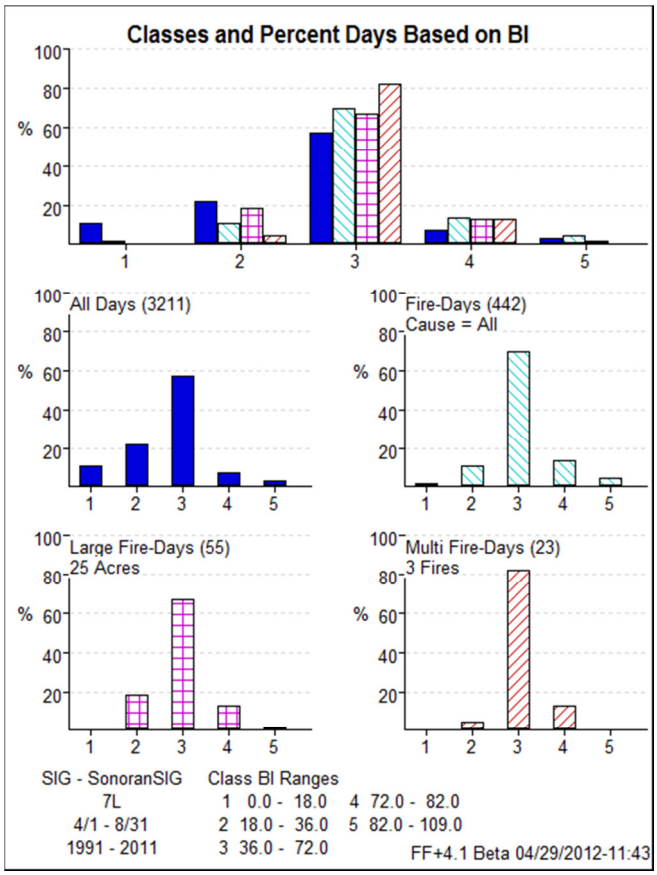
- By December 1, all weather station catalogs will be checked for appropriate freeze dates.
- By April 1, all weather station catalogs will be checked for appropriate green-up dates
- Each year (insert suggested date[s]) the SEZ NFDRS Technical Group will meet to review and update the SEZ NFDRS Operating Plan.
- Other suggestions

VII. Appendices

Appendix A. Preparedness Level Decision Points – Sonoran FDRA

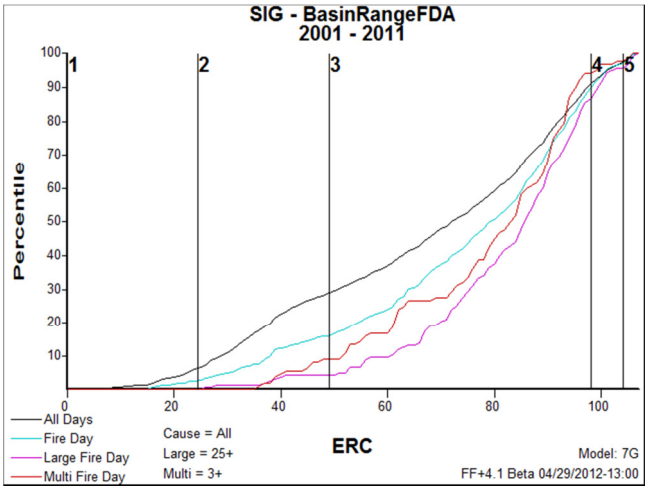


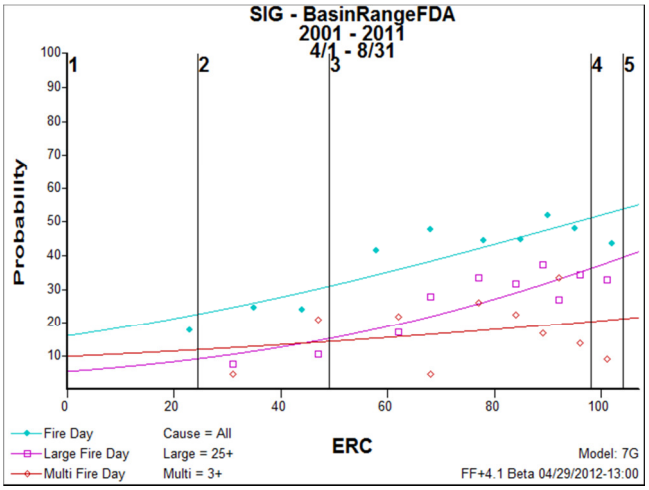


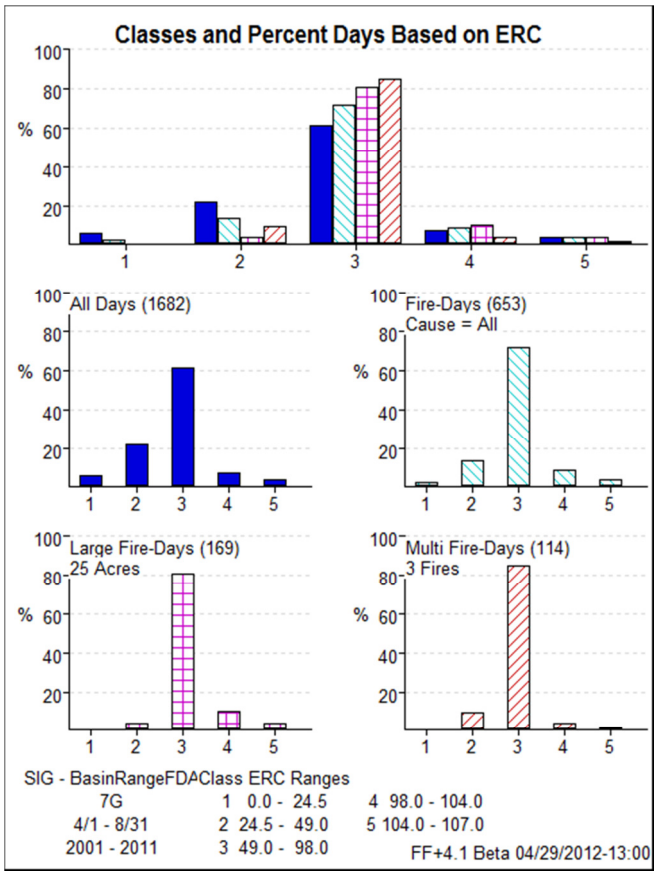


Station/SIG Name/Number	Component Index	NFDRS Fuel Model	Probability Range	R^2	Chi^2	F=Fire Day L-Large Fire Day M=Multi-Fire Day
Sonoran SIG: 021206, 021209, 021202	BI–Burning Index	L-Western Perennial Grasses	0.04 – 0.47	0.86	18.6	F
Sonoran SIG: 021206, 021209, 021202	BI–Burning Index	L-Western Perennial Grasses	0.11 – 0.14	0.01	7.8	L
Sonoran SIG: 021206, 021209, 021202	BI–Burning Index	L-Western Perennial Grasses	0.03 – 0.08	0.08	7.2	M

Appendix A. Preparedness Level Decision Points – Basin and Range FDRA







Station/SIG Name/Number	Component Index	NFDRS Fuel Model	Probability Range	R^2	Chi^2	F=Fire Day L-Large Fire Day M=Multi-Fire Day
Basin and Range SIG: 021005, 021007, 021205, 021414	ERC-Energy Release Component	G-Short Needle (Heavy Dead)	0.17 – 0.55	0.78	21.3	F
Basin and Range SIG: 021005, 021007, 021205, 021414	ERC-Energy Release Component	G-Short Needle (Heavy Dead)	0.07 – 0.41	0.78	8.2	L
Basin and Range SIG: 021005, 021007, 021205, 021414	ERC-Energy Release Component	G-Short Needle (Heavy Dead)	0.11 – 0.22	0.07	34.0	M

Appendix B. Adjective Fire Danger Rating Levels

Fire Danger Rating and Color Code	DESCRIPTION
Low (L) **(Green)**	Fuels do not ignite readily from small firebrands although a more intense heat source, such as lightning, may start fires in duff or punky wood. Fires in open cured grasslands may burn freely a few hours after rain, but woods fires spread slowly by creeping or smoldering, and burn in irregular fingers. There is little danger of spotting.
Moderate (M) (Blue)	Fires can start from most accidental causes but, with the exception of lightning fires in some areas, the number of starts is generally low. Fires in open cured grasslands will burn briskly and spread rapidly on windy days. Timber fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel, especially draped fuel, may burn hot. Short-distance spotting may occur, but is not persistent. Fires are not likely to become serious and control is relatively easy.
High (H) **(Yellow)**	All fine dead fuels ignite readily and fires start easily from most causes. Unattended brush and campfires are likely to escape. Fires spread rapidly and short-distance spotting is common. High-intensity burning may develop on slopes or in concentrations of fine fuels. Fires may become serious and their control difficult unless they are attacked successfully while small.
Very High (VH) **(Orange)**	Fires start easily from all causes and, immediately after ignition, spread rapidly and increase quickly in intensity. Spot fires are a constant danger. Fires burning in light fuels may quickly develop high intensity characteristics such as long-distance spotting and fire whirlwinds when they burn into heavier fuels.
Extreme (E) **(Red)**	Fires start quickly, spread rapidly, and burn intensely. All fires are potentially serious. Development into high intensity burning will usually be faster and occur from smaller fires than in the very high fire danger class. Direct attack is rarely possible and may be dangerous except immediately after ignition. Fires that develop headway in heavy slash or in conifer stands may be unmanageable while the extreme burning condition lasts. Under these conditions the only effective and safe control action is on the flanks until the weather changes or the fuel supply lessens.

Appendix C. Preparedness Level Worksheet (optional)

Southeast Zone, Tucson Dispatch Center

ERC – NFDRS Model G (Sonoran FDRA)	0 - 24		25 - 50		51 - 100		101 - 105		106+	
ERC – NFDRS Model G (Basin and Range FDRA)	0 - 23		24 - 47		48 - 94		95 - 100		101+	
1 ✓ →										
Haines Index	2-4 ↓	5-6 ↓	2-4 ↓	5-6 ↓	2-4 ↓	5-6 ↓	2-4 ↓	5-6 ↓	2-6 ↓	
2 ✓ →										
SWA 7-Day Significant Fire Potential Outlook	No ↓	Yes ↓	No ↓	Yes ↓	No ↓	Yes ↓	No ↓	Yes ↓	No ↓	Yes ↓
3 ✓ →										
Ignition Risk	Low-High ↓	Low ↓	High ↓	Low ↓	High ↓	Low ↓	High ↓	Low ↓	High ↓	Low ↓	High ↓
4 ✓ →										
Fire Activity	Yes or No ↓		No ↓	Yes ↓	No ↓	Yes ↓	No ↓	Yes ↓	No ↓	Yes ↓	Yes or No ↓
5 ✓ →										
Preparedness Level	**I**		**II**		**III**		**IV**		**V**	

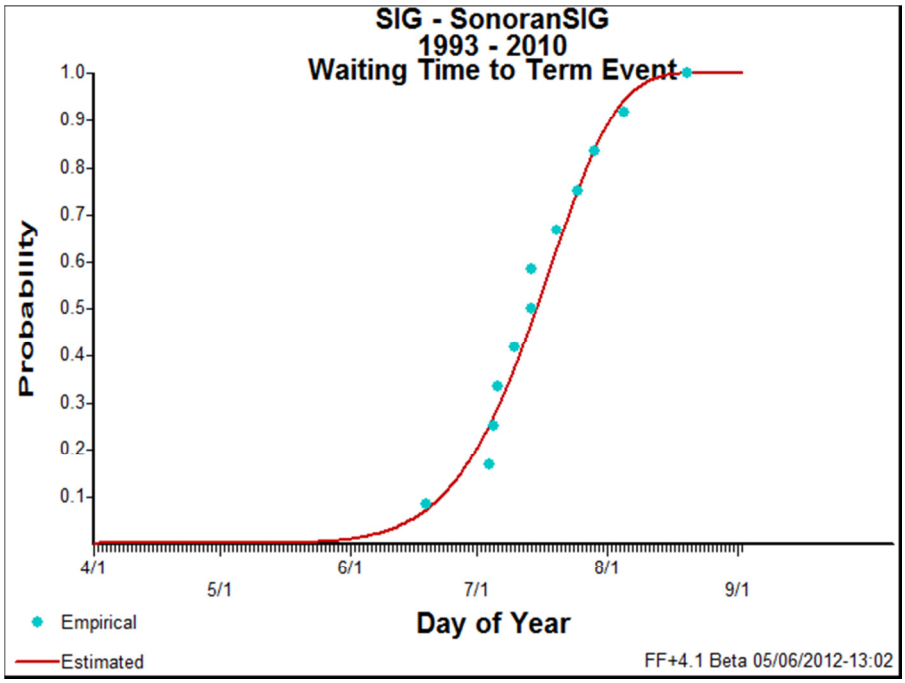
Appendix D. Staffing Levels and Recommended Action Guide

Staffing Level	ERC	Fire Danger Rating	Recommended Daily Staffing and Actions
Staffing Level 1	**0-23** <30th percentile	**LOW** Initiating fires low intensity with low resistance to control; fine fuels drying	• Normal tour of duty 0800 - 1630 • Single engine dispatch initial attack response. • Phone & radio monitored by TDC until 1630 (or longer if initial attack is extended).
Staffing Level 2	**24-47** 31th – 65th percentile	**MODERATE** Initiating fires moderate intensity with low-moderate resistance to control; heavy fuels drying.	All above plus: • Daily roster/staffing reports to SEZ. • Designated acting agency Line Officers for fire season weekends established. • Establish on call dispatcher list • Assess seasonal trends and the need to request severity funding. • Current MOU's with surrounding agencies in place.
Staffing Level 3	**48-94** 66th – 89th percentile	**HIGH** Initiating fires of moderate to moderate-high intensity with potential for spotting w/ winds & passive crowning possible; all fuel classes available at high end BI.	All above plus: • 7 day staffing 0900–1800 M-F and 0900-1800 Sat/Sun. • Consider increased patrols following dry lightning storms. • Consider aerial recon flights after lightning storms. • Consider additional overhead for critical command functions.
Staffing Level 4	**95-100** 90th – 96th percentile	**VERY HIGH** Fires present high intensity and high resistance to control; escapes are common at high end BI; all fuels classes available for rapid combustion; air temps high, humidities low with high winds possible; spotting & intermittent crowning likely.	All above plus: • Briefings for agency administrators as needed. • Notify all SEZ partners of red flag warnings. • Increased engine patrols through areas with historically high incidence of fires. • Additional recon flights after lightning. • Consider fire restrictions; fire safety messages distributed. • Consider canceling planned prescribed fires and postponing project work. • Consider staging call when needed crews on weekends.
Staffing Level 5	**101 +** >97th percentile	**EXTREME** High to extreme intensities with crowning, short-long range spotting common; project fires likely under high wind conditions.	All above plus: Work with SEZ partners to: • Issue fire restrictions and closures. • Evaluate the need to order and preposition additional resources. • Consider daily briefings for agency administrators. • Media coverage on any type of additional fire restrictions or closures.

Appendix E. RERAP Analysis – Sonoran FDRA

Rare Event Risk Assessment Process (RERAP) Analysis (Season Ending/Slowing Event Probabilities) – Sonoran Fire Danger Rating Area

Year	#Days
1993	100
1994	141
1998	95
1999	104
2000	79
2002	104
2003	115
2005	126
2006	94
2007	110
2008	96
2010	119



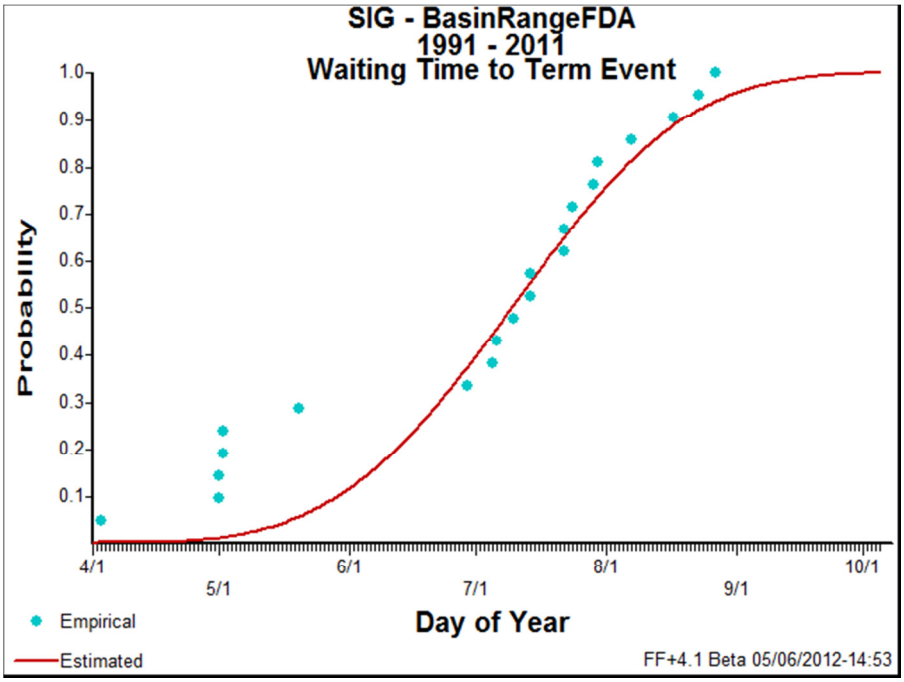
Season Start Day: 4\1
Data Years: 1993 - 2010
Alpha: 7.807696
Beta: 0.009069
R-Squared: 0.976599

Event Definition: Daily(Burning Index) < 75.00 Percentile (60.80) AND Daily(Precipitation Amount) >= 90.00 Percentile (0.10), 3-Day Periods

Appendix E. RERAP Analysis – Basin and Range FDRA

Rare Event Risk Assessment Process (RERAP) Analysis (Season Ending/Slowing Event Probabilities) – Basin and Range Fire Danger Rating Area

Year	#Days
1991	3
1992	31
1993	148
1994	30
1995	138
1996	144
1997	30
1998	120
1999	104
2000	89
2001	96
2002	104
2003	112
2004	2
2005	128
2006	95
2007	112
2008	100
2009	49
2010	119
2011	114



Season Start Day: 4\1
Data Years: 1991 - 2011
Alpha: 3.524738
Beta: 0.009041
R-Squared: 0.900089

Event Definition: Daily(Energy Release Component) < 75.00 Percentile (85.00) AND Daily(Precipitation Amount) >= 90.00 Percentile (0.19), 3-Day Periods

Literature Cited

[i] Anderson, H.E. 1982. Aids to Determining Fuel Models for Estimating Fire Behavior. General Technical Report INT-122, April 1982. NWCG, NFES 1574. pg. 8.

[ii] Anderson, H.E. 1982. Aids to Determining Fuel Models for Estimating Fire Behavior. General Technical Report INT-122, April 1982. NWCG, NFES 1574. pg. 4.

[iii] Scott, J.H. and R.E. Burgan. 2005. Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model. General Technical Report RMRS-GTR-153. Fort Collins, CO: US Department of Agriculture, Forest Service, Rocky Mountain Research Station. p.25.

[iv] Scott, J.H. and R.E. Burgan. 2005. Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model. General Technical Report RMRS-GTR-153. Fort Collins, CO: US Department of Agriculture, Forest Service, Rocky Mountain Research Station. p.35.

[v] Scott, J.H. and R.E. Burgan. 2005. Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model. General Technical Report RMRS-GTR-153. Fort Collins, CO: US Department of Agriculture, Forest Service, Rocky Mountain Research Station. p.45.

[vi] MLRA Explorer. http://www.cei.psu.edu/mlra/. USDA Natural Resources Conservation Service. MLRA 40 Sonoran Basin and Range.

[vii] Anderson, H.E. 1982. Aids to Determining Fuel Models for Estimating Fire Behavior. General Technical Report INT-122, April 1982. NWCG, NFES 1574. pg. 5.

[viii] Anderson, H.E. 1982. Aids to Determining Fuel Models for Estimating Fire Behavior. General Technical Report INT-122, April 1982. NWCG, NFES 1574. pg. 11.

[ix] Scott, J.H. and R.E. Burgan. 2005. Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model. General Technical Report RMRS-GTR-153. Fort Collins, CO: US Department of Agriculture, Forest Service, Rocky Mountain Research Station. p.25.

[x] Scott, J.H. and R.E. Burgan. 2005. Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model. General Technical Report RMRS-GTR-153. Fort Collins, CO: US Department of Agriculture, Forest Service, Rocky Mountain Research Station. p.35.

[xi] Scott, J.H. and R.E. Burgan. 2005. Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model. General Technical Report RMRS-GTR-153. Fort Collins, CO: US Department of Agriculture, Forest Service, Rocky Mountain Research Station. p.45.

[xii] Scott, J.H. and R.E. Burgan. 2005. Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model. General Technical Report RMRS-GTR-153. Fort Collins, CO: US Department of Agriculture, Forest Service, Rocky Mountain Research Station. p.50.

[xiii] Scott, J.H. and R.E. Burgan. 2005. Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model. General Technical Report RMRS-GTR-153. Fort Collins, CO: US Department of Agriculture, Forest Service, Rocky Mountain Research Station. p.56.

[xiv] MLRA Explorer. http://www.cei.psu.edu/mlra/. USDA Natural Resources Conservation Service. MLRA 41 Southeastern Arizona Basin and Range.

[xv] Dept. of Interior: BLM, NPS, USFWS; US Dept. of Agriculture: USFS. 2012. Interagency Standards for Fire and Aviation Operations. NFES 2724. Chap.10. pg.10-3.